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Docket No.: P-093 PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of	:	
Yoon Kwan LEE	:	
Serial No.: 09/531,759	:	Group Art Unit: 2879
Confirm. No.: 6134	:	Examiner: Michael Henry DAY
Filed: March 20, 2000	:	
For: BACKPLATE FOR A PLASMA DISPLAY PANEL AND METHOD FOR FABRICATING THEREOF	:	

SUBMISSION OF CERTIFIED ENGLISH TRANSLATION OF PRIORITY DOCUMENTS

Assistant Commissioner of Patents
Washington, D. C. 20231

Sir:

Applicants filed a response to the Office Action dated January 2, 2003 on March 27, 2003.

As indicated in the Reply and/or Amendment filed on March 27, 2003, please find herewith a copy of the certified English translation for each of the following Priority Documents, upon which application of claim for priority is based:

Korean Patent Application Serial No.: 9554/1999 filed on March 20, 1999; and

Korean Patent Application Serial No.: 15716/1999 filed on April 30, 1999.

Respectfully submitted,
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Date: April 8, 2003

IN THE MATTER OF
KOREAN PATENT APPLICATION
UNDER SERIAL NO. 15716/1999

I, THE UNDERSIGNED, HEREBY DECLARE :
THAT I AM CONVERSANT WITH BOTH THE KOREAN AND THE ENGLISH LANGUAGES : AND

THAT I AM A COMPETENT TRANSLATOR OF THE APPLICATION PAPERS THE PARTICULARS OF WHICH ARE SET FORTH BELOW :

KOREAN PATENT APPLICATION UNDER SERIAL NO.: 15716/1999

FILED ON: APRIL 30, 1999

IN THE NAME OF: LG ELECTRONICS INC.

FOR: A METHOD FOR COATING PHOSPHOR MATERIAL OF A PLASMA DISPLAY PANEL

IN WITNESS WHEREOF, I SET MY HAND HERETO

THIS 28TH DAY OF MARCH, 2003

BY ----------

KIM, EUN HEE

[Translation]

ABSTRACT OF THE DISCLOSURE

[Abstract]

The present invention relates to a plasma display panel, and more particularly, to a method for coating phosphor material uniformly in a plasma display panel. The method for coating phosphor material of PDP comprising steps of: coating a photosensitive phosphor material on a front surface of a substrate having a barrier rid; spraying a compression gas so that the photosensitive phosphor material is uniformly coated deeply and uniformly; and light-exposing and developing the regions which will be coated with the phosphor material. According to the method for coating phosphor material of PDP, the phosphor material can be uniformly coated on the discharge cell having the barrier rib more than 500μm by using compression gas.

[SPECIFICATION]

[Title of the Invention]

A method for coating phosphor material of a plasma display panel

[Brief description of the Drawings]

Figure 1 is a sectional view showing a discharge cell of a general three-electrode alternating current type plasma display panel;

Figure 2 is a flow chart showing a method for coating phosphor material using a screen printing method;

Figures 3A to 3C are sectional views showing a method for coating phosphor material using a screen printing method;

Figure 4 is a flow chart showing a method for coating phosphor material using a sandblast method;

Figure 5 is a flow chart showing a method for forming phosphor material according to one preferred embodiment of the present invention; and

Figures 6A to 6D are sectional views showing a method for forming phosphor material according to preferred embodiments of the present invention.

**** Explanation for the major reference numerals ****

10 : upper substrate	12, 40 : lower substrates
14, 32 : barrier ribs	16 : a pair of sustain electrode
16A : transparent electrode	16B: bus electrode
18 : lower dielectric	20 : passivation film
22 : address electrode	24 : lower dielectric
26, 34 : phosphor materials	28 : screen mask

30, 36: squeezes 38: mask

[Detailed description of the invention]

[Object of the invention]

[Field of the invention and background art]

The present invention relates to a plasma display panel, and more particularly, to a method for coating phosphor material uniformly in a plasma display panel.

Recently, a research for a plasma display panel (PDP) having the highest potentiality in a large flat type display market is being greatly performed. The PDP generally uses gas discharge, and visual rays are generated in accordance with that vacuum ultraviolet rays generated at the time of the gas discharge excite phosphor material. By using the visual rays, a certain character or graphic is displayed.

Referring to Figure 1, a structure of a discharge cell of three-electrode alternating current type PDP is illustrated.

The discharge cell of the PDP of Figure 1 is provided with an upper substrate 10 for displaying a screen, and a lower substrate 12 arranged parallel to the upper substrate 10 by a barrier rib 14. The barrier rib 14 forms a discharge space in a cell so as to shield electric and optical interference between cells, and supports the upper substrate10 and the lower substrate 12. A pair of sustain electrodes 16, that is, an injection/sustain electrode and a sustain electrode, are arranged side by side on the upper substrate 10. The pair of sustain electrode are composed of a transparent electrode 16A and a bus electrode 16B. An address electrode 22 for performing discharge with the pair of sustain electrode 16 is arranged on the lower substrate 12. Also, an lower dielectric 18 for charge accumulation is flatly formed on the upper substrate 10 on which the pair of sustain electrode 16 are arranged. The lower dielectric 18 forms wall charge, maintains discharge by discharge sustain voltage, protects

electrode from ion impact at the time of gas discharge, and prevents a diffusion of ions. A passivation film 20 formed at an surface of the lower dielectric protects the dielectric 18 from a sputtering phenomenon of plasma particles and thus prolongs a life span, enhances an emitting efficiency of secondary electron, and reduces discharge characteristic change of fireproof metal due to oxide contamination. As the passivation film, MgO is mainly used. A lower dielectric 24 is formed on the lower substrate 12 on which the address electrode 22 is arranged, and on the lower dielectric 24, phosphor material 26 for emitting visual rays of own colors is coated through the barrier rib 14. The phosphor material 26 is excited by vacuum ultraviolet of short wavelength generated at the time of gas discharge, thereby generating visual rays of red, green, and blue. Also, a mixed gas of He-Ne and Ne-Xe is filled in a discharge space formed in the discharge cell. In this discharge cell, the vacuum ultraviolet rays is selected by address discharge between the address electrode 22 and the sustain electrode 16, and generated by continual sustain discharge between the sustain electrodes 16. The vacuum ultra violet rays excite the phosphor material 26 and emits the visual rays, so that the PDP displays a desired image.

In this PDP, the phosphor material 26 is excited and transited by ultraviolet of 147nm wavelength generated at the time of the plasma discharge, and thus emits the visual rays of the red, green, and blue. In this case, the phosphor material is required uniform coating characteristics besides own material characteristics.

To this end, methods for coating the phosphor material include a screen printing method, a sand blast method, a photolithography method, and an electric melting method. Among these methods, the screen printing method and the sandblast method are the most wisely used, and other methods are being developed.

Figure 2 is a flow chart showing a method for coating phosphor material using a screen printing method.

In the second step, a screen mask for coating red phosphor is located on the lower substrate where the barrier rib is formed, and in the fourth step, the red phosphor is printed and dried to coat the red phosphor material. Then, in the sixth to twelfth steps, green or blue phosphor materials are sequentially coated by the same method with the aforementioned steps. In this case, a method for coating the red, green, or blue phosphor materials using the screen printing method is shown in Figures 3A to 3C.

First, as shown in Figure 3A, a screen mask 28 having a sequentially deposited structure of the address electrode 22, the lower dielectric layer 24, and the barrier rib 14 is positioned on the lower substrate 12. Then, red, green, or blue phosphor material 30 of a paste state is printed on the lower substrate where the screen mask 28 is arranged by using a squeeze 32. Then, the screen mask 28 is removed. As the result, as shown in Figure 3B, the phosphor material 30 is coated on the lower substrate with a similar height to the barrier rib 14. Then, if the lower substrate where the phosphor material 30 of the paste state is dried, an organic solvent included in the phosphor material 30 is evaporated. According to this, as shown in Figure 3C, a volume thereof is decreased, and thus the phosphor material 26 is coated only on surfaces of the lower dielectric layer 24 and the barrier rib 14.

Figure 4 is a flow chart showing a method for coating phosphor material using a sandblast method.

In the step 22, the red phosphor material is printed and dried on the front surface of the lower substrate where the barrier rib is formed. Then, in the step 22, the red phosphor material is light-exposed by using a desired masking and developed, so that the red phosphor material is coated only on a corresponding region with a height of the barrier rib. Then, in the steps 24 to 30, the green and red phosphor materials are sequentially coated on the corresponding region with the height of the barrier rib by the same method. Then, in the step 32, the phosphor material is partially removed by using the sand blast, so that the phosphor

material is coated only on the surface of the lower dielectric layer and the barrier rib. Finally, the lower substrate where the phosphor material is coated is molded to complete a phosphor layer.

In the conventional screen printing method or sand blast method, in the case that the height of the barrier rib is 100-200μm, it is possible to coat the phosphor material at the height of the entire barrier ribs. However, in case that a height of the barrier is more than 500 μm, the phosphor material can not be coated uniformly by the conventional coating method. The reason is because the barrier rib where the phosphor material is coated is formed of material of glass or glass-ceramics having a high friction coefficient, and thus the phosphor material can not flow into a deep portion at the time of printing the phosphor material of the paste state. Moreover, in case of the PDP using the high frequency discharge in order to increase the discharge efficiency, a distance between two electrodes which generate a high frequency discharge has to be enough obtained. Therefore, the height of the barrier rib is generally 1000-200μm. In this PDP having high barrier rib height, the phosphor material can not be uniformly coated by the conventional screen printing method or the sand blast method, thereby generating non-uniform thickness of the phosphor material. Therefore, if the thickness of the coated phosphor material layer is non-uniform, the reflection of the visual light outputted from every discharge cell is non-uniform for thereby causing a certain image distortion. In particular, it is difficult to uniformly coat the phosphor with respect to the high frequency PDP of a lattice structure formed of the discharge cells having a high height of the barrier rib in order to prevent any optical interference between discharge cells. In addition, it is difficult to accurately adjust the position of the screen mask for coating red, green, and blue phosphor materials on a corresponding cell. According to this, a method for uniformly coating the phosphor material on the discharge cell having a high height of the barrier rib is sincerely required.

Therefore, an object of the present invention is to provide a method for coating phosphor material of PDP which can uniformly coat the phosphor material on the discharge cell having the barrier rib more than 500μm.

[Construction of the present invention]

To achieve the above object, there is provided a method for coating phosphor material of PDP comprising steps of: coating a photosensitive phosphor material on a front surface of a substrate having a barrier rid; spraying a compression gas so that the photosensitive phosphor material is uniformly coated deeply and uniformly; and light-exposing and developing the regions which will be coated with the phosphor material.

Another object and advantages of the present invention will be clarified with reference to attached drawings.

Hereinafter, preferred embodiment of the present invention will be explained with reference to Figures 5 to 6D.

Figure 5 is a flow chart showing a method for forming phosphor material according to one preferred embodiment of the present invention.

Referring to Figure 5, a red phosphor material is coated on the entire surface of the backplate of the PDP having a relatively high height without using the screen mask, and then the compressed gas is sprayed so that the coated film of the phosphor material formed on the discharge cell is punctured by the pressure of the gas. Thereafter, when the phosphor material is uniformly coated on the surface of the barrier ribs, and the mask is positioned, and the discharge cells coated with the red phosphor material are exposed to a ultraviolet ray and developed, so that the red phosphor material is removed with respect to the remaining portions resulting remaining the light-exposed red phosphor material.

Figures 6A to 6D are sectional views showing a method for forming phosphor material according to preferred embodiments of the present invention.

As shown in Figure 6A, the red phosphor material is coated on the entire portion of the lower substrate 40 having the barrier rib 32. The photosensitive phosphor material 34 having a density of about 40000cps is flown over the lower substrate 40 having the barrier rib 32 without using the screen, and then the phosphor material is coated on the entire portion of the front surface using the squeeze 36 based on a certain pressure. The squeeze 36 is slanted at an angle of over 60° with respect to the substrate, and the scan speed of the same is set to 20cm/min, and the phosphor material 34 is scanned one or two times for thereby uniformly coating the phosphor material 34 on the lower substrate.

In the case that the height of the barrier rib 32 is over 500 μm, even when the phosphor material 34 is coated all over discharge cells, the phosphor material 34 does not reach the deep portion of the barrier ribs 32. Even if the phosphor material 34 is heated over 100°C, the possibility that the phosphor material 34 of the discharge cell is punctured is about 40%. Therefore, the flow of the phosphor material 34 flown into the deepest portion of the barrier rib 32 is only 30% with respect to the entire percentages. In order to overcome the above-described problem, as shown in Figure 3B, the compression gas such as nitrogen is sprayed onto the phosphor material which covers the discharge cells, so that the phosphor material 34 is uniformly coated on the surface of the barrier surface. At this time, the nitrogen gas is sprayed on the phosphor material 34 coated film based on a spraying pressure of $2Kg/cm^2$. Therefore, the phosphor material coated film which covers each discharge cell is punctured, so that the phosphor material 34 is flown to the lower portion along the surface of the barrier 32 based on the pressure of the gas. At this time, the possibility that the phosphor material coated film formed on the discharge cells is 100%. In particular, more than 95% of the phosphor material is uniformly flown to the lowest portion of the barrier ribs 32 by the compression gas. Therefore, the substrate 40 uniformly coated with the phosphor material 34 formed on the surfaces of the barrier rib 32 is dried for 20 minutes at

about 120°C. Then, as shown in Figure 3C, the discharge cells which will be coated with the red phosphor material by positioning the mask on the dried lower substrate is exposed to an ultraviolet ray, and the remaining portions are not exposed to the ultraviolet ray by the mask. The lower substrate exposed to the ultraviolet ray is rinsed for about one minute using a D.1 water based on a pressure of $2Kg/cm^2$. Therefore, as shown in Figure 3D, the phosphor material 34 of the exposed portions remains, and the phosphor material of the remaining portions are all removed. The above-described process is performed with respect to the green and blue phosphor material in the same manner for thereby removing the phosphor material.

Therefore, in the phosphor material coating method according to the present invention, it is possible to uniformly coat the phosphor material layer on the discharge cells having higher than 500 μm of the barrier rib using an inert gas like nitrogen together with the front surface thin film coat.

[Effect of the invention]

As so far described, when the case that the height of the barrier rib is above 500 μm, in the method for uniformly coating the phosphor material on the substrate, the phosphor material is coated on the front surface of the lower substrate without using the screen mask, and the compression gas is sprayed onto the surface of the phosphor material which covers the lower substrate, so that it is possible to uniformly coat the phosphor material to deep portion of the barrier rib.

Therefore, in the method for coating the PDP phosphor material according to the present invention, it is possible to uniformly coat the phosphor material at a certain thickness irrespective of the shape and height of the barrier rib, so that the images are not distorted due to the difference in the amount of the visual light.

As the present invention may be embodied in several forms without departing from

the spirit or essential characteristics thereof, it should also be understood that the above-described embodiment is not limited by any of the details of the foregoing description, unless otherwise specified, but rather should be construed broadly within its spirit and scope as defined in the appended claims, and therefore all changes and modifications that fall within the meets and bounds of the claims, or equivalence of such meets and bounds are therefore intended to be embraced by the appended claims.

What is claimed is:

1. A method for coating phosphor material of plasma display panel comprising steps of:

coating a photosensitive phosphor material on a front surface of a substrate having a barrier rid;

spraying a compression gas so that the photosensitive phosphor material is uniformly coated deeply and uniformly; and

light-exposing and developing the regions which will be coated with the phosphor material.

2. The method of claim 1, further comprising a step of drying the substrate where a photosensitive phosphor material is coated.

3. The method of claim 1, wherein density of the photosensitive phosphor material is 40000 cps or below.

4. The method of claim 1, wherein a squeeze is slanted at an angle of over 60° with respect to the substrate, and the scan speed of the same is set to 20cm/min, and the phosphor material is scanned for uniformly coating the phosphor material on the substrate.

5. The method of claim 1, wherein inert gas such as nitrogen gas having $2Kg/cm^2$or below is sprayed on the phosphor material as the compression gas.